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NATIONAL LABORATORY

Center for Remediation of Complex Sites

May 15, 2020

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CENTER FOR THE REMEDIATION OF COMPLEX SITES
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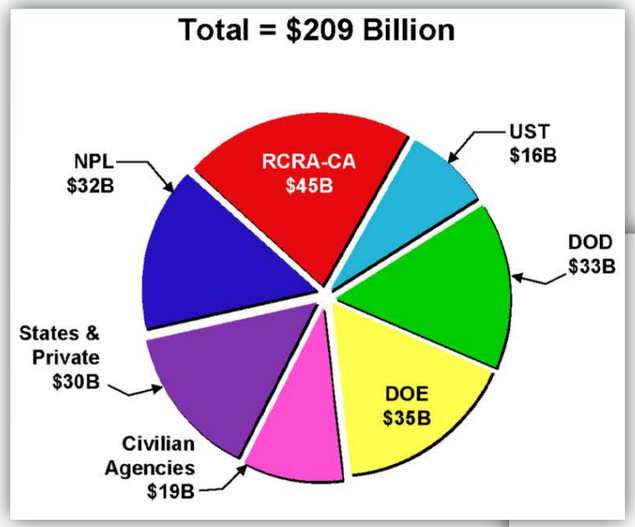
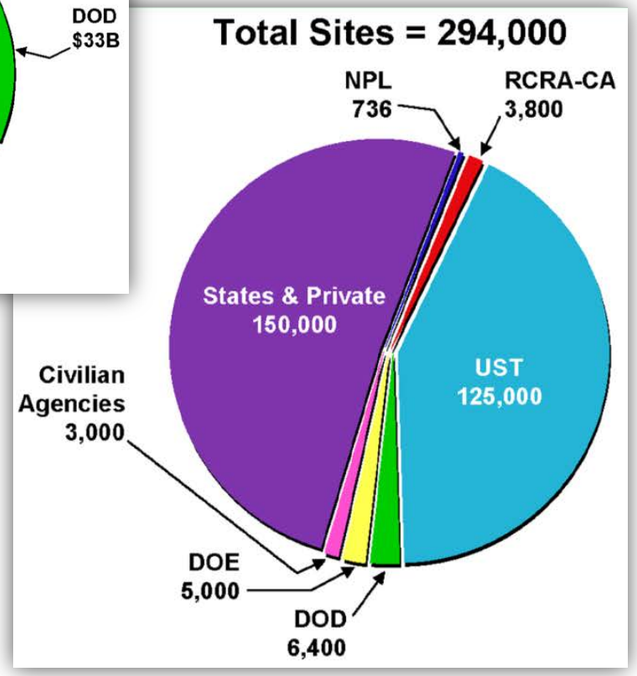
PNNL-SA-153205

Complex Site Challenges

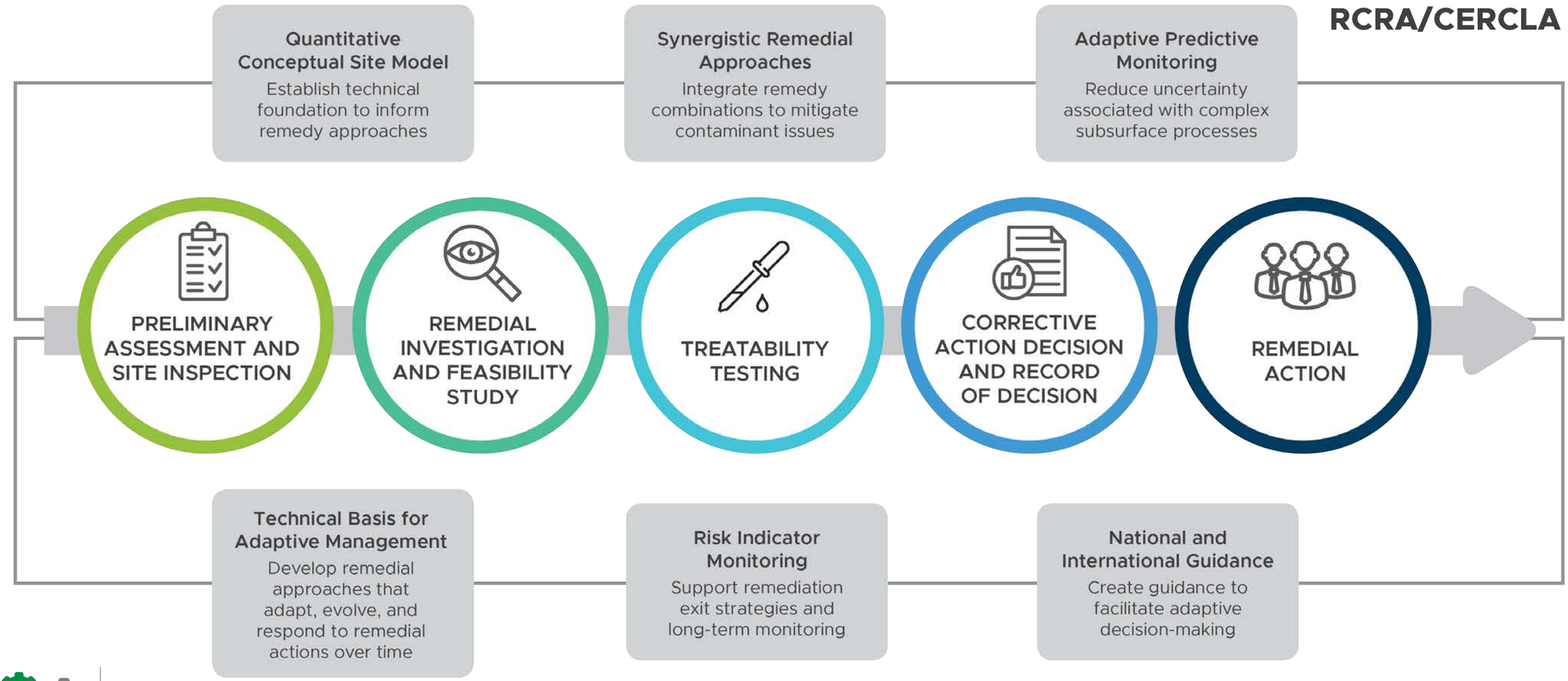




- EPA, 2004
  - Technical complexities limiting remediation and closure of ~300,000 sites and ~$200B
- National Research Council, 2013
  - Technical complexities preventing closure of ~13,000 Sites 50-100 years
  - "*…extensive groundwater contamination, heterogeneous geology, large releases and/or source zones, multiple and/or recalcitrant contaminants, heterogeneous contaminant distribution in the subsurface, and long time frames since releases occurred.*"
- Interstate Technology & Regulatory Council, 2017
  - "*Sites where remediation progress is uncertain, and remediation is not anticipated to achieve closure or even long-term management within a reasonable timeframe.*"

Over 50 Years of Experience

Regulatory-Aligned Support for Remediation, Closure & Stewardship



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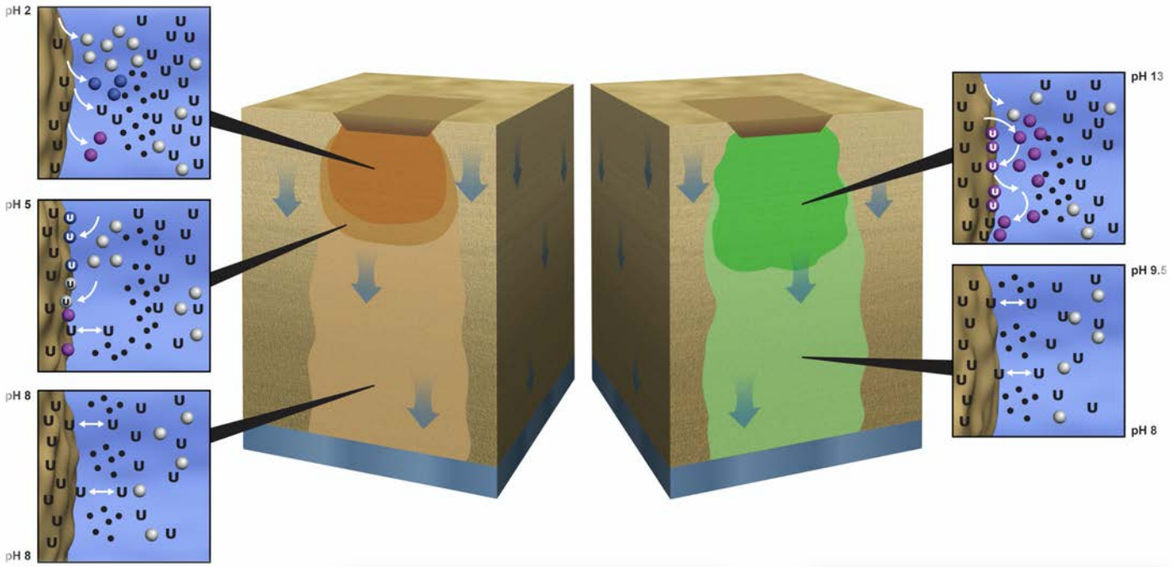
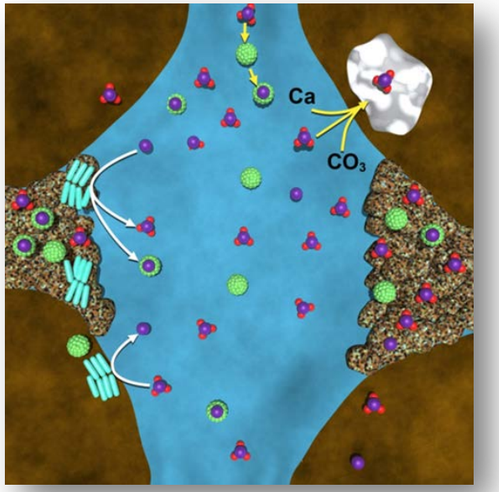
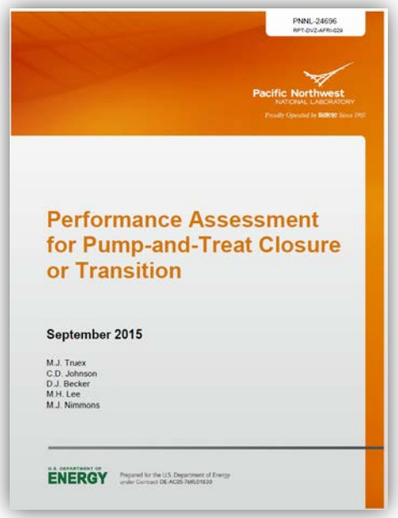
Signature Capabilities

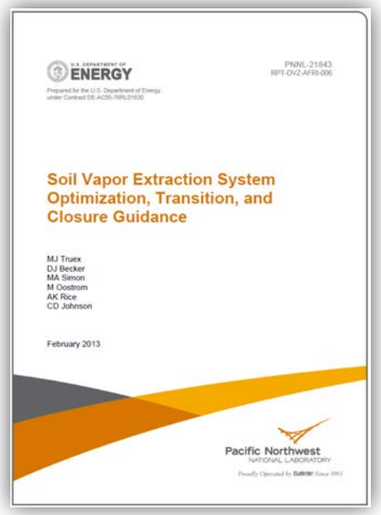
Integrating Complex Dynamics for Remediation, Closure, and Monitoring

- Coupled Hydrogeologic Dynamics
  - Groundwater – Surface Water
  - (Deep) Vadose Zone – Groundwater
- Interaction of Biogeochemistry and Contaminants
  - Co-mingled contaminants
  - Sorption behavior and reactions
  - Persistent/recalcitrant contaminants
  - Extreme environments/contaminant discharge chemistry
- Exit Strategies
  - Active to passive
  - Current to long-term management
  - Adaptive site management steps









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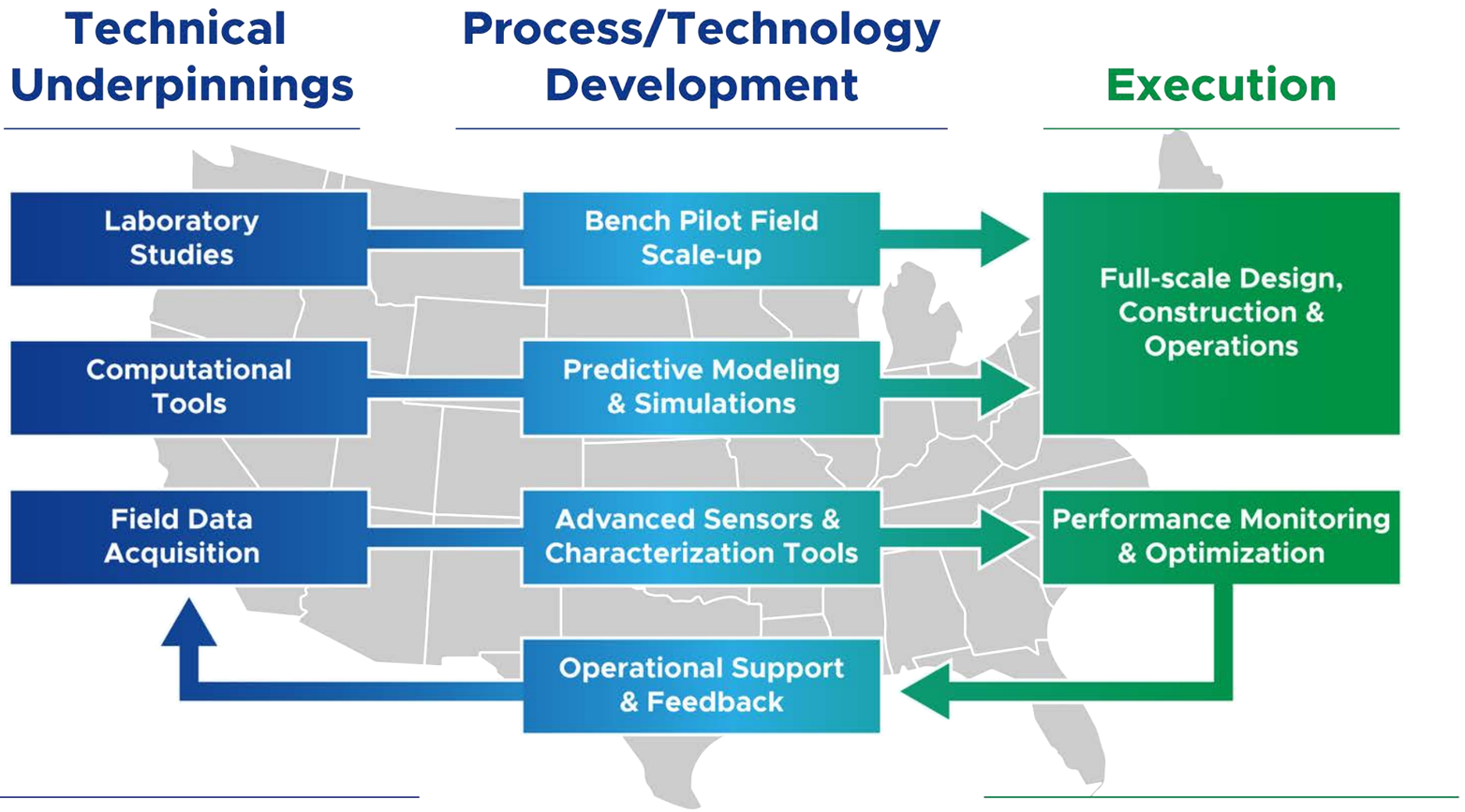
Applied Environmental Partnerships



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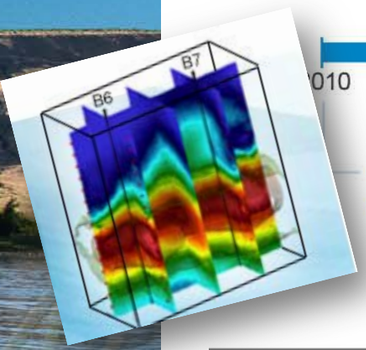
Site Owner & Cleanup Contractor

DOE, DOD, and EPA

Multi-program/agency Leveraging, Integration, and Impact

Real-time Geophysical Monitoring of Complex Processes



- Technology development (e.g., ERT)
- Demonstration and validation at DOE sites

- Tech transfer of technologies to DoD and EPA
- Demonstrated at 10 DoD and EPA sites

- ERT demonstrations at Hanford including 300A, real-time imaging, linking with eSTOMP, infrastructure code

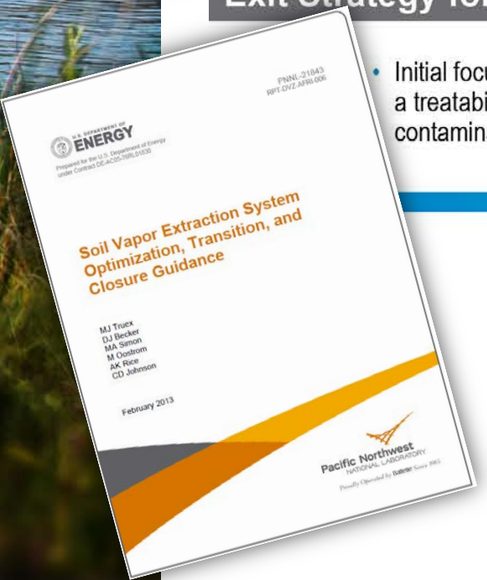
- ERT included in ESTCP and SERDP projects

- ERT evaluated by EPRI for leak detection at nuclear power plants

- ERT applied for real-time amendment delivery monitoring during remedy implementation and to support site characteri-zation at Hanford

2010 2011 2012 2013 2014 2015 2016 2017 2018

Exit Strategy for Soil Vapor Extraction (SVE)



- Initial focus of flux framework on organic contaminants in the vadose zone with a treatability test conducted for the Hanford 200-ZP-1 operable unit to define contaminant source as part of justifying Soil Vapor Extraction (SVE) shutdown

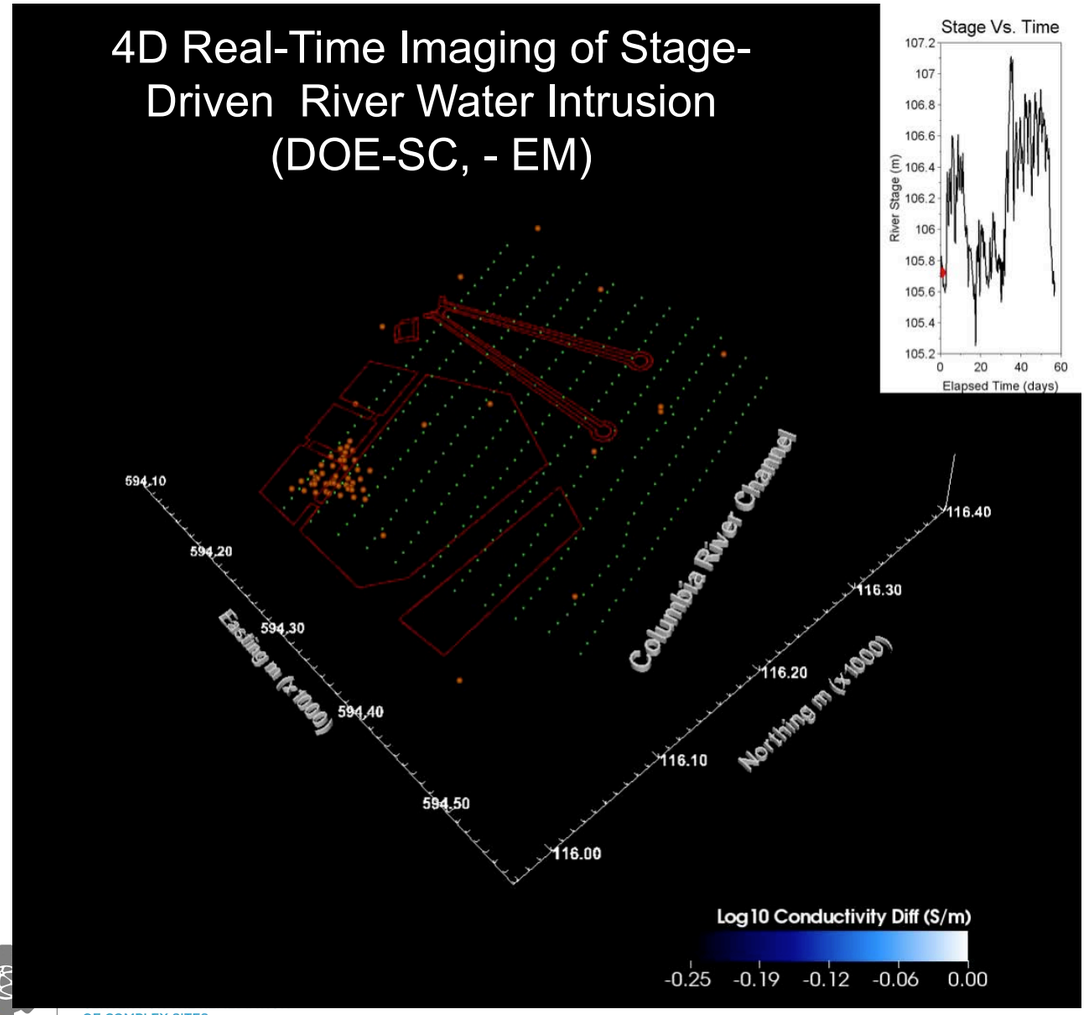
- PNNL, USACE, and EPA team publishes a guidance document and assessment tool for evaluating SVE performance and shutdown
- Vadose zone flux framework concept extended by PNNL to inorganic and radionuclide contaminants

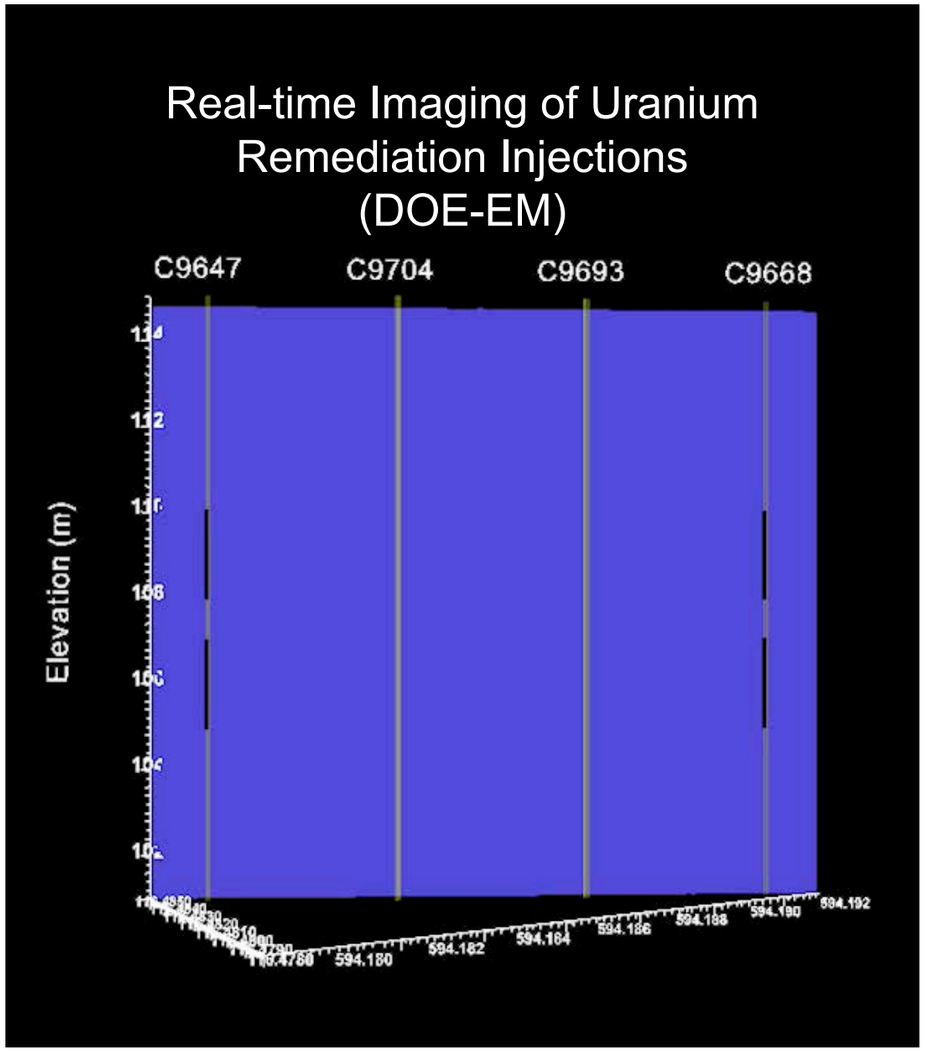
- Technical consultation provided by PNNL to the Hanford 200-DV-1 deep vadose zone operable unit for a characterization work plan

- Hanford 200-ZP-1 operable unit proposes and obtains shutdown of SVE system with PNNL technical support
- 400+ public users have downloaded the SVE performance and shutdown guidance and assessment tool
- EPA contracts with PNNL for assistance applying SVE guidance and tools
- Technical approach for evaluating vadose zone transport of inorganic and radionuclide contaminants published by PNNL

- DoD funds update of SVE exit strategy and supporting calculation tool

2011 2012 2013 2014 2015 2016 2017 2018





https://e4d.pnnl.gov/Pages/Home.aspx

Partnership

- Collaborative proposals for research
- Sponsored research
  - Strategic Partnership Projects (SPP)
  - Agreement for Commercializing Technology (ACT)
- Collaborative research
  - Cooperative Research and Development Agreement (CRADA)
- Licensing
- Facility use

Remediation Industry

Federal Entities & National Laboratories

Academia

https://community.pnnl.gov/sites/ISSTExternal/Lists/Reports/Attachments/406/Tech%20Innovation%20for%20Busi%20Flyer.pdf

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Center for the Remediation of Complex Sites

The Center for the Remediation of Complex Sites (RemPlex) is a Pacific Northwest National Laboratory (PNNL) platform that couples unique core competencies and expertise with state-of-the-art facilities and physical assets to develop, mature, and deploy advanced technologies to solve complex issues of contaminated subsurface environments.

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Supporting Remediation and Closure of Complex Sites

Current Exemplar Activities

Technical Basis for Remediation

- Developing quantitative conceptual models to support remediation of recalcitrant co-mingled ^{99}Tc, ^{129}I, and U plumes
- Providing attenuation-based assessment of contaminant behavior to support remedy selection
- Providing scientific basis and web-based decision analytics tools to support remedy decisions and optimization

Systems-Based Assessment for Remediation

- Conducting treatability testing for sustainable remediation of comingled plumes
- Providing technical defensibility for remedy selection and technical impracticability waiver evaluation
- Developing subsurface amendment delivery technologies for source mitigation in perched and deep vadose zones

Systems-Based Monitoring

- Implementing advanced geophysics for spatio-temporal characterization, amendment delivery, and reaction monitoring
- Demonstrating advanced geophysical techniques for surface barrier performance monitoring
- Implementing systems-based monitoring for integrated site-wide groundwater and deep vadose zone monitoring

Activities and Resources

Seminar Series

June 2020	Implications of Uranium Behavior in the Subsurface for Environmental Remediation
July 2020	Interactions of Inorganic Contaminants and Carbonate Precipitates
Aug 2020	Evaluation Approaches for Transitioning from Active to Passive Remediation
Sept 2020	Understanding Environmental Site Conditions: What do we need to know to select and implement effective remedies?

Trainings & Short Courses

April 2020	Using Remedy Implementation Information to Guide Remedy Optimization
TBD	E4D Training Workshop
2021	IAEA Site Characterization Short Course
2023	IAEA Remedial Design and Implementation Short Course

Publications

Environmental Management and Remediation of Radionuclide Contaminated Sites

- Special Issue, November 2019
- PNNL Guest Editors: Christopher Bagwell, Catherine Yonkofski, Nikolla Qafoku

Technical Engagement & Insight

Mar 2020	Waste Management Symposia
Oct 2020	Clay Minerals Society Annual Meeting
June 2021	Battelle Chlorinated Conference
Nov 2021	RemPlex Summit

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International and Nationally Recognized Expertise to Provide Continuity in Remediation and Stewardship

Solution Development – Leverage existing capabilities spanning all TRLs, to provide solutions in adaptive remediation and long-term stewardship that enable risk-based remediation

Multi-institutional Collaborations – Integration and leveraging across federal and private partnerships to facilitate solution development

Technical Leadership – Independent technical resource with proven track record of supporting deployment of advanced technologies and alternative strategies

Leadership

Dawn Wellman, Ph.D.
Director

Vicky Freedman, Ph.D.
Deputy Director of Collaborative Research

Alicia Gorton, Ph.D., PMP
Deputy Director of Operations

Mike Truex
Deputy Director of Environmental Remediation Applications

Nik Qafoku, Ph.D.
Deputy Director of Outreach & Engagement

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Thank you

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